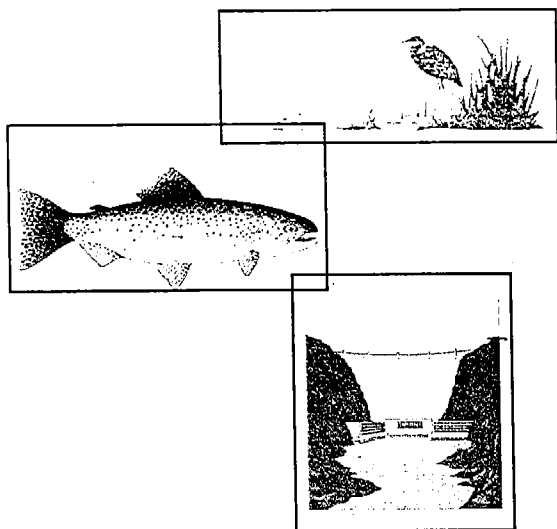


- Resources. California Department of Fish and Game, Sacramento, California. 56 p.
- SWRCB (State Water Resources Control Board). 1992. State Water Resources Control Board Water Rights Hearing on the Lower Yuba River, Yuba County Water Agency v. State Water Resources Control Board. February-June, 1992.
- U.S. Fish and Wildlife Service. 1996. Recovery plan for the Sacramento/San Joaquin San Joaquin Delta native fishes.
- U.S. Fish and Wildlife Service. 1997. Revised draft anadromous fish restoration plan: a plan to increase natural production of anadromous fish in the Central Valley of California. May 30, 1997.
- Yoshiyama, R.M., E.R. Gerstung, F.W. Fisher, and P.B. Moyle. 1996. Historical and present distribution of chinook salmon in the Central Valley drainage of California. Sierra Nevada Ecosystem Project: Final report to Congress, vol.III. Centers for Water and Wildland Resources.

◆ AMERICAN RIVER BASIN ECOLOGICAL MANAGEMENT ZONE



INTRODUCTION

The American River Basin Ecological Management Zone is located east of the Sacramento River and lies between the Bear River to the north and the Cosumnes River to the south. The total watershed encompasses about 2,000 sq. mi. (California State Lands Commission 1993). The zone consists of several watersheds adjacent to and including the American River. These watersheds includes smaller creeks that drain into the Natomas Cross Canal (NCC), the Natomas East Main Drainage Canal (NEMDC), Morrison Creek, and the lower American River below Folsom and Nimbus Dams. The NCC and NEMDC form the watersheds of the American Basin including the Natomas Basin, located east of the Sacramento River between the Bear River and American River watersheds. Morrison Creek is a small watershed located just south of Sacramento and the American River that drains into the north-eastern portion of the Delta in the Stone Lakes area.

The health of the Sacramento-San Joaquin River Delta depends on the condition of the streams that make up its watershed. The American River is one of the largest tributaries within the Delta's watershed. The other streams of the basin are minor but potentially important contributors. Water, sediment, and nutrients from the American River and the other watersheds are important factors governing the

ecological health of San Francisco Bay and Delta, including many estuarine fish species and their foodwebs. The American Basin was once an important wintering area of waterfowl the use the Central Valley portion of the Pacific flyway.

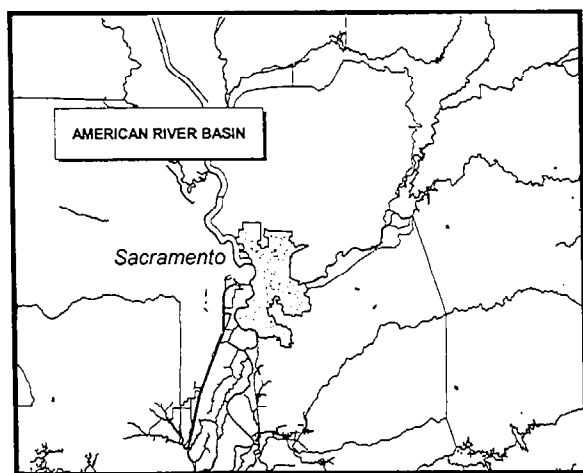
The American River is also an essential watershed for the spawning, rearing, and migrating fall-run chinook salmon, steelhead, striped bass, and American shad, which must pass through the Bay and Delta during portions of their life cycle. Although their period of residence in some cases (e.g., steelhead) in the Bay and Delta may be brief, it constitutes an important part of the life cycles of these fish species. Hence, the population status of these anadromous fish species is influenced by human activities that affect both their freshwater riverine and Bay-Delta estuarine habitats.

The two ecological factors with the greatest influence on anadromous fishes of the lower American River are seasonal stream flow and water temperature. In addition spawning gravel, stream-channel dynamics, shaded riverine aquatic (SRA) and riparian habitats also are important factors. Stressors such as dams, legal and illegal harvest, water quality (e.g., water temperature and toxins from urban runoff), and artificial propagation of anadromous fish further affect the population dynamics of anadromous fish in watersheds of the zone.

DESCRIPTION OF THE MANAGEMENT ZONE

The American Basin Ecological Management Zone is located in the east-central portion of Central Valley. Its eastern boundary is the Sierra foothills. The western boundary is the Sacramento River and Delta. The northern boundary is the Feather River Ecological Management Zone. The southern boundary is the Cosumnes River Ecological Management Zone. This Ecological Management Zone has two Ecological Management Units:

- American Basin, and
- Lower American River.



Location Map of the American River Basin Ecological Management Zone.

LIST OF SPECIES TO BENEFIT FROM RESTORATION ACTIONS IN THE AMERICAN RIVER BASIN ECOLOGICAL MANAGEMENT ZONE

- fall-run chinook salmon
- steelhead trout
- splittail
- native resident fishes
- lamprey
- American shad
- giant garter snake
- neotropical migratory birds
- Swainson's hawk
- waterfowl
- non-native warmwater gamefish
- plants and plant communities.

DESCRIPTIONS OF ECOLOGICAL MANAGEMENT UNITS

AMERICAN RIVER BASIN ECOLOGICAL MANAGEMENT UNIT

The American River Basin Ecological Management Unit includes the watersheds between the American and Feather River systems on the east side of the Sacramento Valley. The streams included from North to South are Coon Creek, Markham Ravine, Auburn Ravine, Pleasant Grove Creek, Curry Creek, Dry Creek, and Arcade Creek. These creeks enter the floodplain drainage systems of the Natomas Cross

Canal (NCC) and the Natomas East Main Drainage Canal (NEMDC) in southern Sutter and northern Sacramento counties. The NCC drains into the Sacramento River just south of the Feather River, while the NEMDC drains into the Sacramento River just to the north of the American River. The NEMDC watershed is comprised of the Dry Creek and Arcade Creek watersheds. Dry Creek's headwater watersheds include Linda Creek, Cirby Creek, Miners Ravine, and Antelope Creek, which come together and form Dry Creek near the City of Roseville in southern Placer County. Dry Creek then flows southwest through Sacramento County to the NEMDC in the City of Sacramento. The NCC watershed includes Coon Creek with its main tributary Doty Creek, Markham Ravine, Auburn Ravine with its main tributary Dutch Ravine, Pleasant Grove Creek, and Curry Creek.

Once large wetland areas, the American Basin floodplain is now principally rice fields in the north and central areas, with the metropolitan area of the City of Sacramento in the south. The Sacramento River levee marks the western boundary of the unit. The northern boundary is the Bear River watershed. The southern boundary is the American River watershed. The eastern boundary is the upper watersheds of the Bear and American Rivers. Above the floodplain the creeks pass through the rolling hills of Placer County, and the cities of Lincoln, Roseville, and Rocklin. This central portion of the creek watersheds is a mixture of agricultural lands, grasslands, and oak woodlands. The upper eastern portion of the unit consists of the upper watersheds of Coon Creek, Auburn Ravine, and Dry Creek that extend upslope into Sierra foothills near the City of Auburn. Here lands are a mixture of oak-pine woodlands and orchards, intermixed with other agricultural and municipal developments.

The unit has a Mediterranean climate with wet winters and dry summers. With only a maximum elevation of about 1,500 ft, little or no snow melt enters the upper watershed of the unit. The eastern foothill portion of the unit receives more rainfall (about 40 inches) than the valley portion (about 20 inches). Of the streams, Coon, Doty, Auburn Ravine, Dry Creek, Linda Creek, Miners Ravine, Secret Ravine, and Antelope Creek have sufficient summer flow from diversions from other basins, ground water, storm drains, irrigation returns, or sewage treatment

effluent to be considered perennial. Water is also diverted from the upper Bear and American River watersheds into the Coon Creek, Auburn Ravine, and Dry Creek watersheds for irrigating lands in the American Basin.

Stream flows have been modified by water diversions, subsidence in ground water tables, and watershed activities such as grazing, road building, wetland management, forest management, and agriculture. In wetter periods all the streams are essential in carrying stormflow. Drains and ditches in the lower floodplain convey floodwaters to the NCC, NEMDC, and RD 1000 pumping plants on the Sacramento River.

In drier periods, creeks of the unit are used to carry drain water, convey irrigation water, or are intermittent. During the spring through fall irrigation season, much of the water in these streams is diverted along their paths to irrigation. In the lower floodplain, water is pumped into the basin from the Sacramento River and dispersed through the system of irrigation canals maintained by the Natomas Central Mutual Water Co. (NCMWC) for irrigation.

In all but wetter years, winter-spring rainwater is conveyed from the natural floodplain of the American Basin to the Sacramento River via the NCC, NEMDC, and drainage ditches. In wettest years large portions of the floodplain are subject to flooding from overtopping levees or simply filling with rainwater. Floodwaters are eventually drained and pumped to the Sacramento River.

The American Basin Ecological Management Unit has two distinct geomorphological areas: the hilly east side in the Sierra Foothills and the valley floodplain on the western side adjacent to the Sacramento River. The western portion of the unit in the Sacramento Valley floodplain is best described as an agricultural belt with some managed wetlands. Most of the land is in rice production and is 20 to 30 feet of elevation or less.

The NCC's northern extension, the East Side Canal, and its southern extension, the Pleasant Grove Creek Canal capture the flows of the creek's of the NCC watershed and convey them to the NCC and west to the Sacramento River. The NCC has a capacity of 22,000 cfs, which in high water years is insufficient to carry flood flows, thus water tends to back up into

the lower creek drainages despite channel capacities totaling 36,000 cfs. The NEMDC captures the flows of Dry and Arcade Creeks and conveys them to the Sacramento River just upstream from the mouth of the American River.

Lands west of Pleasant Grove Creek Canal and the NEMDC to the Sacramento River are in the Natomas Basin. These lands and those west of the East Side Canal were once floodplain marshes connected to the Sacramento River, and are now protected from flooding by levees and a series of drainage canals operated by Reclamation District 1000 that drain rainwater, floodwaters, and irrigation return water back to the Sacramento River via a system of drainage ditches and pumping stations. In the southern portion of Natomas Basin there are extensive developments including the Sacramento Metropolitan Airport, Arco Arena, Interstate Highways 5 and 80, and the City of Sacramento. Of the approximately 50,000 acres in Natomas Basin, approximately 40,000 are croplands (mostly rice), 5,000 are urban, 1,500 are roads, 1,500 are vacant, and 3,000 are wetlands or open water.

East of the Natomas Basin and East Side Canal the floodplain extends up the watersheds of the creeks. Rice fields dominate the low lands, while grasslands and oak woodlands with mixed agriculture and pasture lands occur between the creek bottoms. Elevation rises gradually from west to east from 30 feet to about 100 feet elevation. Lincoln, Roseville, and other Sacramento suburbs are located in this portion of the unit.

Further to the east begins the foothills to the east of Lincoln, Roseville and Sacramento. Here the watersheds of Coon Creek, Auburn Ravine, and Dry Creek tributaries rise quickly to elevations near 1,000 feet near the City of Auburn in Placer County. The creeks flow through forested ravines. The hills are a mixture of orchards, woodlands, grasslands, pastures, and other agricultural and municipal developments. In some locations the creeks are dammed creating small ponds and wetlands. Some areas have quality riparian forests, while others are degraded from livestock grazing or other land use activities.

Important habitats in the unit are wetlands, riparian forests, and grasslands. Marshes, once the most widespread habitat in the American Basin floodplain, are now restricted to remnant patches. There have

been extensive reclamation of emergent wetland habitat to agricultural development. Most of the remaining wetlands lack adjacent upland transition habitat and other attributes of fully functioning wetlands. Seasonal wetlands include portion of the floodplain that flood in winter and spring, especially in high rainfall years. Most of this habitat is located in the Valley floor adjacent to the Sacramento River. Seasonal wetlands once covered large areas of the Basin during the winter rainy season or after seasonal flooding. With reclamation, flooding occurs primarily from accumulation of rainwater behind levees, from inflow to the basin of flood waters carried by the foothill creeks, or from water diverted to leveed lands (e.g. rice lands and managed wetlands). Seasonal wetlands are important habitat to many species of fish, waterfowl, shorebirds, and wildlife. Vernal pool habitat is common in the central and eastern portion of the floodplain.

Riparian habitat, both forest and shrub, is found on the water and land side of levees and along creek channels of the unit. This habitat ranges in value from disturbed (i.e., sparse, low value) to relatively undisturbed (i.e., dense, diverse, high value). The highest value riparian habitat has a dense and diverse canopy structure with abundant leaf and invertebrate biomass. The canopy and large woody debris in adjacent aquatic habitat provide shaded riverine aquatic habitat on which many important fish and wildlife depend on during some portion of the life cycles. The lower value riparian habitat is frequently mowed, disced, or sprayed with herbicides, disturbed by livestock grazing and watering, resulting in a sparse, habitat structure with low diversity. Riparian habitat is used by more wildlife than any other habitat type. From about 1850 to the turn of the century most of the riparian forests in the Central Valley were decimated for fuelwood as a result of the gold rush, river navigation, and agricultural clearing. Remnant patches are found on levees, along stream channels, and along the margins of marshes. Riparian habitats and their adjacent shaded riverine aquatic habitat benefit many species of fish and wildlife. There is little riparian habitat in the western, floodplain portion of the unit. Riparian habitat is more prevalent along the creeks from the valley floor to the basin headwaters, but suffers in places from effects of livestock grazing and watering, as well as urban development.

Upland habitats are found on the eastern floodplain and foothills and consist primarily of grasslands and oak woodland and oak savanna. Of these perennial grasslands are an important transition habitat for many wildlife species and are buffers to protect wetland and riparian habitats. Much grassland habitat associated with wetland and riparian habitat has been lost to agriculture (i.e. pasture, grain, vineyards, and orchards) and development (i.e., airports, sports complexes, industrial parks, home construction, golf courses). Grasslands are important buffers of wetland and riparian habitat and provide habitat for many plant and animal species.

Agricultural habitats are also important habitat as they support populations of small animals, such as rodents, reptiles, and amphibians, and provide opportunities for foraging shorebirds, waterfowl, and raptors. Nonflooded fields and pastures are also habitat for pheasants, quail, and doves. Preferred habitat of raptors consists of tall trees for nesting and perching in proximity to open agricultural fields, which support small rodents and insects for prey. Both pasture land and alfalfa fields support abundant rodent populations. Rice lands provide invertebrates and amphibians for shorebirds, waterfowl, and snakes.

Important biological resources in this Ecological Management Unit include the giant garter snake, Swainson's hawk, fall-run chinook salmon, steelhead, waterfowl, as well as many other native plants and wildlife found within the diversity of habitat types. Though creeks of the basin contain chinook salmon and steelhead in small numbers, the creeks are primarily warm water habitats that sustain largemouth and smallmouth bass, catfish, sunfish, suckers, and minnows including squawfish and carp.

The giant garter snake (GGS) is a State and federally listed threatened species whose habitat is marsh lands with adjacent uplands used for shelter from flooding and winter hibernation. There have been numerous observations of the GGS in this unit. They appear to do well in the systems of drainage and irrigation canals and rice fields, and other seasonal wetlands.

Swainson's hawks are a State listed threatened species found primarily along the riparian corridor of the Sacramento River on the west side of this unit. At one time they were likely found in the riparian corridors of the floodplains of the creeks of this unit. They

forage widely over the unit in grasslands and agricultural areas.

Wild juvenile fall-run chinook salmon have been found in small numbers in Coon Creek, Doty Creek, Auburn Ravine, and the upper creek watersheds of Dry Creek, including Secret Ravine, Antelope Creek, and Miners Ravine. Juvenile salmon raised in the Feather and American River hatcheries have been stocked since 1983 in several streams including Coon Creek, Auburn Ravine, and tributaries of Dry Creek. With Bear and American water present in many of these creeks, salmon from these rivers may stray into the creeks of the American Basin. Both Coon Creek and Auburn Ravine have been stocked with fingerling fall-run chinook salmon during the 1990s. Dry Creek, Auburn Ravine, Doty Ravine, Secret Ravine, and Coon Creek received plants of Feather River spring-run chinook salmon in the mid 1980s. Adult salmon carcasses have been observed in Antelope Creek, Miners Ravine, and Secret Ravine in the late fall. In 1963 and 1964 DFG surveys indicated 300-800 wild fall-run chinook salmon spawned successfully in Secret Ravine, where spawning gravels were once adequate for over 1,000 salmon. DFG surveys indicate that Doty Ravine has sufficient spawning habitat for 400 salmon redds. Salmon are limited by low flows and high water temperatures in the fall during the upstream migration of adults and in the spring during the downstream migration of juveniles.

Rainbow trout/steelhead fry have been found in Coon Creek, Auburn Ravine, Dry Creek and, tributaries of Dry Creek, particularly Secret Ravine and Miners Ravine. Adult steelhead have been observed in Auburn Ravine and steelhead smolts have been found in Dry Creek, Secret Ravine, and Miners Ravine. Steelhead/rainbow trout require cool waters and sufficient flow through the summer and fall to sustain their populations. Such habitat still exists in the upper watersheds of these creeks. Inter-basin diversions into these creeks from the Bear and American River watersheds probably helps sustain steelhead.

Native fishes resident in the creeks of the unit include Sacramento squawfish, Sacramento sucker, hitch, California roach, and hardhead. These fish are adapted to higher winter-spring and low summer fall flows and warmer summer-fall water temperatures of the creeks.

Splittail migrate from the Bay-Delta into the lower rivers to spawn in late winter and early spring. They seek flooded lands to spawn including those of the Yolo and Sutter Bypasses. In wet years they likely migrate upstream into the lower NCC and NEMDC and spawn in flooded portions of creeks of this unit.

LOWER AMERICAN RIVER ECOLOGICAL MANAGEMENT UNIT

The American River is a major tributary to the Sacramento River, with their confluence located at the City of Sacramento. It provides approximately 15% of the total Sacramento River flow. The American River ranges in elevation from 23 feet to more than 10,000 feet and drains a watershed of approximately 1,900 square miles. Average annual precipitation in the watershed ranges from 23 inches on the valley floor to 58 inches at the headwaters. Approximately 40% of American River flow results from snowmelt. The American River has three major branches: the South, Middle, and North Forks, all of which drain into Folsom Reservoir. Average historical unimpaired runoff at Folsom Dam is 2.8 million acre-feet (af).

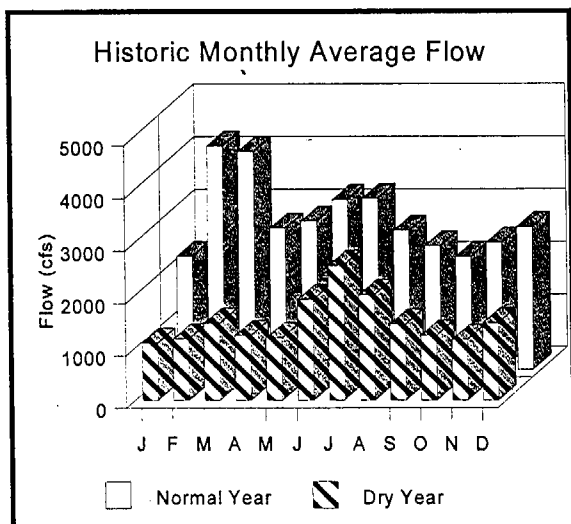
The American River meanders through a 4,800-acre floodplain that is bordered, for the most part, by low bluffs in its upper course and levees along its lower course. Most of the floodplain between the levees and opposite the bluffs has been acquired by either the City or County of Sacramento and is managed cooperatively as the American River Parkway. The lower American River, below Nimbus Dam, is also listed as a State and federal Wild and Scenic River and designated as "recreational".

Development on the American River began in the early days of the Gold Rush when numerous small dams and canals were constructed. Today, the drainage has three major and 10 smaller reservoirs with a total storage capacity of 1.9 million af. Folsom Lake, the largest reservoir in the drainage, was constructed in 1956 and has a storage capacity of 974,000 af. Proposed additional water project developments in the basin are the 2.3-million-af Auburn Dam and the 225,000-af South Fork American River project. Folsom Dam, located approximately 30 miles upstream from the mouth of the American River, is a major element of the federal

Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation (Reclamation) as an integrated system to meet contractual water demands and instream flow and water quality requirements.

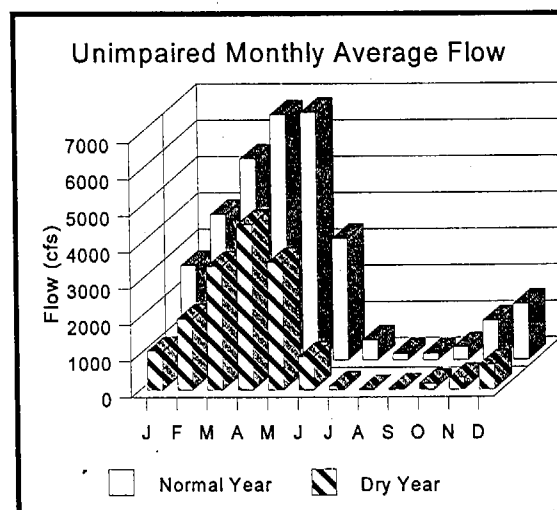
The American River has a natural pattern of moderate flows in winter, high flows in spring, very low flows in summer, and low flows in fall. This pattern is atypical of northern Sacramento Valley streams, which are fed by springs from the Cascade Range, and more similar to San Joaquin River tributaries. Flows in the Sacramento River and tributaries usually peak in March, whereas flows on American and San Joaquin River tributaries peak progressively later in spring from north to south. Natural (unimpaired) flows on the American River in dry and normal rainfall years generally peak from March to May.

Annual rainfall in the watershed is also highly variable. In the wettest years, unimpaired flows average 20,000-34,000 cubic feet per second (cfs) in winter months. In the driest years, unimpaired flows in winter months average only 200-800 cfs. Unimpaired spring flows, particularly in March through May, are generally more dependable, ranging from 1,300-1,500 cfs in driest years, 3,500-4,500 cfs in dry years, and 5,000-6,500 cfs in normal years. Unimpaired flows during summer and early fall are 0 cfs in the driest years, increasing to 1,000-6,000 cfs in the wettest years. In median rainfall years, unimpaired summer and early fall flows are generally 100-500 cfs.



Historic Monthly Average Flow on the American River below Nimbus Dam, 1962-1992 (Dry Year Is the 20th Percentile Year; Normal Year Is the 50th Percentile or Median Year)

Because the watershed contains 13 reservoirs, the natural flow pattern of the lower American River has been altered extensively. Spring flows have been greatly reduced, summer and fall flows have increased substantially, and winter flows are relatively unchanged. Annual variability has been reduced by the release of water from Folsom Reservoir in drier years. Peak average monthly flows in high rainfall years remain unchanged from unimpaired flows. Summer and early fall flows in the driest years average 300-900 cfs, whereas unimpaired flows average 0 cfs. Dry- and normal-year flows in summer and early fall months consistently average 1,200-3,200 cfs, whereas unimpaired flows average less than 500 cfs. Fall and winter flows have increased slightly in dry and normal years. Spring flows (March through May) have decreased from an unimpaired level of 3,500-4,500 cfs to 1,200-1,500 cfs in dry years. In normal rainfall years, spring flows are 2,800-4,200 cfs, compared to unimpaired flows of 5,500-6,800 cfs. A similar decline in spring flows has occurred in wet years.

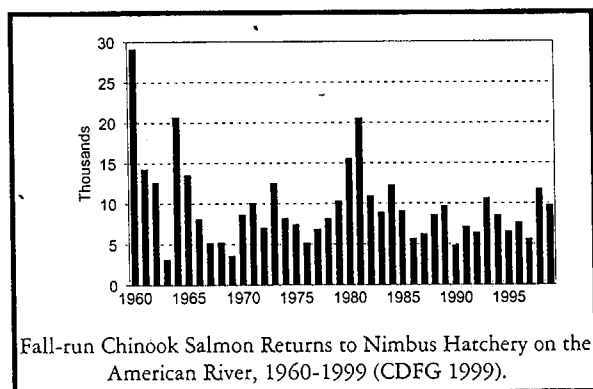
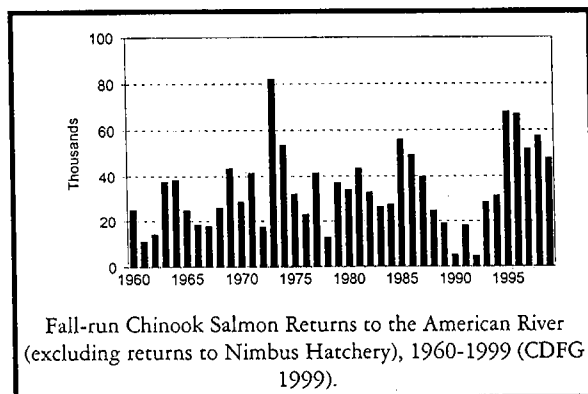


Unimpaired Monthly Average Flow on the American River below Nimbus Dam, 1962-1992 (Dry Year Is the 20th Percentile Year; Normal Year Is the 50th Percentile or Median Year)

Important aquatic resources that depend on the Lower American River and its riparian habitats include naturally spawning fall-run chinook salmon, steelhead, American shad, other native fish assemblages, amphibian populations, and lower trophic organisms. Important aquatic habitats include holding, spawning, rearing, and migration habitats for all fish species; sufficient quantities of

high-quality water at the appropriate temperature; and riparian and SRA habitats.

The American River historically supported steelhead trout and chinook salmon that spawned principally in the upper watershed above the valley floor. There is historical documentation of chinook salmon in the North, Middle, and South forks, and steelhead in the North Fork and Middle Fork as far upstream as the rubicon River (Yoshiyama et al. 1996). Each population probably exceeded 100,000 fish. Salmon and steelhead runs have declined significantly in the lower American River because of the combined effects of dams blocking traditional spawning and rearing areas (nearly all of the steelhead historical spawning and rearing habitat is located above Nimbus Dam (McEwan and Nelson 1991), altered seasonal flow regimes resulting from dam operations, severe flow fluctuations that dewater redds and strand juveniles, and high water temperatures during crucial periods of salmon and steelhead development.



Historically, over 125 miles of riverine habitat were available for anadromous fish in the American River system. Since the 1890s a dam, which included a semi-functional fish ladder which passed relatively

low numbers of spring-run chinook salmon and steelhead, was located at Folsom. A relatively large run of fall-run chinook salmon became established in the reach of the river below the old Folsom Dam (Clark 1929). Counts of steelhead passing through the fishway on the old Folsom Dam from 1943 to 1947 indicate that the majority of the steelhead were spring-run which ranged in number from 200 in 1944 to 1,252 in 1948 (USFWS and CDFG 1953). These fish passed through the fishway from May through July en route to their upstream spawning and rearing areas. In 1950, flood waters destroyed the ladder, eliminating upstream spawning and rearing areas and in 1955 Nimbus Dam was closed and became the upstream terminus of anadromous fish migration. The native spring-run steelhead was probably eliminated at this time.

Decision 893 (D-893), issued by the California State Water Resources Control Board (SWRCB), established the minimum allowable riverflow in the lower American River as 500 cfs from September 15 through December 31 and 250 cfs from January 1 through September 14. This flow regime is inadequate to maintain anadromous fish in the present spawning and rearing areas of the lower American River below Nimbus Dam. Except for drought years such as 1976-77 and water-years 1989-1992, flows have seldom dropped to these minimum levels.

Since Folsom Dam and Reservoir were constructed, Reclamation has made releases that are legally constrained by the outdated fish flow requirements of D-893, which allows flows in the river during dry years to be as low as 250 cfs. Nevertheless, Reclamation voluntarily releases amounts sufficient to meet D-1400 (discussed below) when water is available. In recent years, Reclamation has made an attempt to voluntarily implement the flow objectives established by the Anadromous Fish Restoration Program (AFRP).

SWRCB Decision 1485 (D-1485) established water quality standards for the Delta that require additional releases from upstream storage facilities, including Folsom Reservoir. Reclamation has relied on releases from Folsom Reservoir to help meet the standards imposed by D-1485 because of its location near the Delta and the high probability of refill in the winter. This change in operation has reduced the carryover storage in Folsom Reservoir, which has resulted in less

cold water being retained through summer and fall in the reservoir. This, in turn, has often resulted in high summer and fall water temperatures (above 70°F) in the lower American River.

In 1993, the Sacramento Area Flood Control Agency (SAFCA) prepared and distributed environmental documentation associated with operating to a new flood control diagram, known as the 400-670 Variable Flood Control Diagram. As part of the SAFCA work to provide a net beneficial effect to the salmonid resources of the American River, water temperature modeling and hydrologic modeling were conducted to evaluate the beneficial effect of the shutter reconfiguration at Folsom Dam.

The California Department of Fish and Game's recently completed the Lower American River Steelhead Management Plan identifies poor habitat conditions in the lower American River as a problem for steelhead. Cold water temperatures cannot be maintained year round in the lower American River because of the limited amount of cold water present in Folsom Reservoir that is available for releases to the river. In addition, the practice of clearing trees and other objects from the river to eliminate hazards to recreationists reduces instream cover for juvenile steelhead rearing in the river.

Among the most significant factors affecting the American River ecosystem are altered natural runoff patterns, impaired channel maintenance processes, and loss of connectivity between upstream spawning and rearing habitats and the lower river following construction of Folsom and Nimbus Dams. These changes have resulted in the following:

- exclusion of salmon and steelhead from many of their historic upstream spawning and rearing areas,
- altered seasonal river flow and water temperature,
- significant reduction in high-quality spawning and rearing habitats,
- armoring of existing instream gravel resources,
- elimination of natural stream meanders, and
- loss of islands and riparian vegetation.

Because of these changes, the lower American River is managed to provide or emulate, as much as possible, the conditions that formerly existed upstream of Folsom Dam.

Other important habitats have been severely disrupted by water storage and diversions, as well as levee construction and maintenance. Rapid flow fluctuations strand salmon and steelhead eggs and juveniles on higher terraces and in side channels. The present condition of migration, spawning, and nursery habitat for American River salmon and steelhead limits and impairs recruitment and survival of juvenile fish. Boating and rafting safety programs remove woody debris and overhanging SRA habitat from the river, thereby reducing the quality of important rearing habitats

Rearing habitat quality for young salmon and steelhead also has been reduced by low flows and associated high water temperatures, especially in drought years. Folsom Dam has a limited capacity for selective withdrawal of cold water from deeper portions of the reservoir to control downstream water temperatures. At Nimbus Dam, turbine intakes draw in the heated surface waters of Lake Natoma rather than the cooler, deeper flows from Folsom Dam. When turbines are not operating at Nimbus Dam, heated surface water from Lake Natoma is released over spillways to the river below the dam.

Some of the gravel beds in the river below Nimbus Dam have either been washed downstream or become armored and, therefore, are no longer moved by seasonal peak flows. Floods wash gravel downstream or onto high terraces along the river, where it is of little value. Many natural side channels still retain the scars of extensive dredger mining from nearly a century ago; others have been eliminated and no longer provide nursery or rearing habitat for juvenile salmon and steelhead. In some cases the river is connected to former dredger ponds (e.g., near Arden Pond and at the Sailor Bar pond), that may increase already high river water temperatures locally, and can provide refuges for predatory, non-native warm water fishes such as smallmouth and largemouth bass. Reduced river flows, rip-rap bank protection, and levees contribute to the decline or impairment of natural sediment transport and channel maintenance processes, which have combined to substantially reduce natural gravel recruitment and transport in the river.

Another factor limiting production of naturally spawning salmon and steelhead is the presence of large numbers of native and non-native predators and competitors. The highly modified flow regime and altered instream habitat have provided potential advantages to striped bass, Sacramento squawfish, suckers, smallmouth and largemouth bass, resident trout, and American shad. Sport and commercial harvest also remove chinook salmon and steelhead adults from the natural spawning population.

VISION FOR THE ECOLOGICAL MANAGEMENT ZONE

The vision for the American River Basin Ecological Management Zone includes restoring important fishery, wildlife, and plant communities by restoring ecological processes, habitats and reducing the adverse affects of stressors. The vision for this Ecological Management Zone focuses on restoring an ecologically based streamflow plan, improving the supply and accessibility of sediments, maintaining the existing stream meander configurations, maintaining water temperatures in the lower American River to support anadromous fish, and supporting the development of locally sponsored watershed planning. The vision also encourages restoring a variety of aquatic, riparian, and terrestrial habitats for fish, wildlife, and plant communities.

VISIONS FOR ECOLOGICAL MANAGEMENT UNITS

AMERICAN BASIN ECOLOGICAL MANAGEMENT UNIT

The vision for the American Basin Ecological Management Unit includes improved water quantity and quality from the basin to sustain aquatic, wetland, riparian, and upland habitats that support natural production of an abundance of resident fish and wildlife, as well as waterfowl and other migrant birds that use the Pacific Flyway each winter. The vision includes improving, restoring, and enlarging areas of remaining native habitats and establishing connectivity of those areas. Native habitats include riparian, emergent wetlands, season wetlands, and grasslands.

The vision focuses on improving watershed, stream channel, and floodplain processes that would lead to

increased seasonal flows of quality water in the creeks, and area wetlands, and reducing the input of agricultural waste runoff and associated contaminants into unit watersheds and wetlands, and the Sacramento River. Improvements in the quality and quantity of water supplies provided to publicly and privately managed wetlands will reduce stresses on waterfowl populations. Additional water quality improvements can be achieved by tertiary water treatment plants to improve effluent discharges. Improvements in water quality and quantity to unit creeks and the Sacramento River will directly benefit fish and wildlife of the Sacramento River and the Bay-Delta.

Floodplain habitat improvement would be the focus of efforts in the western portion of the unit. Riparian and stream channel improvements would be the focus of efforts in the middle and upper watersheds. Seasonal wetlands for migratory species such as waterfowl and shore birds would be expanded and improved. Present restoration efforts can be expanded by ensuring adequate supplies of high quality water to the seasonal wetlands. Water supplies can be improved by reducing or eliminating diversions in streams and sloughs that flow into wetlands. Restoring natural watershed, stream, and floodplain processes along creek watersheds will promote natural habitat restoration. Emphasis should also be placed on connecting habitats and providing habitat corridors necessary for species such as the giant garter snake, Swainson's hawk, waterfowl, and neotropical birds.

Throughout much of the central and upper (eastern) portion of the unit creek restoration would provide higher quality water and improved habitats for salmon and steelhead. Exclusion of cattle along the streams and creeks, limitation of gravel mining, and reduction of diversions would improve stream channels and riparian corridors. Reforestation of cottonwood and other riparian forest species has not been possible because cattle range through the creek bottoms and land owners divert water for irrigation. Facilitating passage at numerous seasonal dams would allow better access to upstream spawning and rearing habitat.

The narrow strips of grasslands and riparian vegetation along levees, irrigation canals, and drainage ditches would be protected and restored where possible. More environmentally sound means